

ABSTRACT OF THE DISCLOSURE

Disclosed are a method of producing a crystalline semiconductor material capable of improving the crystallinity and a method of fabricating a semiconductor device using the crystalline semiconductor material. An amorphous film is uniformly irradiated with a pulse laser beam (energy beam) emitted from an XeCl excimer laser by 150 times so as to heat the amorphous film at such a temperature as to partially melt crystal grains having the {100} orientations with respect to the vertical direction of a substrate and melt amorphous film or crystal grains having face orientations other than the {100} orientations. Silicon crystals having the {100} orientations newly occur between a silicon oxide film and liquid-phase silicon and are bonded to each other at random, to newly form crystal grains having the {100} orientations. Such a crystal grain creation step is repeated, to form a crystalline film which has crystal grains preferentially grown in the {100} orientations with respect to the vertical direction of the substrate and thereby has sharp square-shaped crystal grain boundaries.